



PRESIDENT'S MALARIA INITIATIVE



Guyana Vector Control Needs Assessment Report

Integrated Vector Management (IVM) Task Order 2

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Table Of Contents

Executive Summary.....	3
1.0 Introduction	5
2.0 SITUATIONAL ANALYSIS	7
2.1 STRUCTURE, RESOURCES, AND FUNCTIONS.....	7
2.1.1 Structure	7
2.1.2 Decentralization	9
2.1.3 Information Management for Vector Control	10
2.1.4 Human Resources	11
2.1.4a Training.....	13
2.1.5 Financing	13
2.1.6 Potential Collaborative Institutions and Programs.....	14
2.1.6a Global Fund	14
2.1.6b Human Rights Programme	15
2.1.6c Georgetown City Council	15
2.1.6d UNICEF	15
2.2 MAJOR VECTOR-BORNE DISEASES	17
2.2.1 Malaria	17
2.2.2 Dengue	17
2.2.3 Lymphatic Filariasis	18
2.2.4 Leishmaniasis	18
2.3 TOOLS, METHODS, STRATEGIES, AND COVERAGE.....	18
2.3.1 Long-Lasting Insecticidal Nets (LLINs)	18
2.3.2 Indoor Residual Spraying (IRS)	19
2.3.3 Fogging for dengue control.....	20
2.3.4 Larval Source Management	21
2.3.4a <i>Bacillus thuringensis</i>	21

2.3.5	Insecticides.....	21
2.3.6	Entomological Monitoring	22
2.3.7	Community Mobilization.....	23
2.3.8	The Special Case of Mining and Other Mobile Communities	23
3.0	OPPORTUNITIES FOR ADDRESSING VECTOR CONTROL CHALLENGES.....	25
3.1	Improved Data Management and Utilization for Vector Control	25
3.2	Develop Framework for Entomological Monitoring and Surveillance.....	26
3.3	Improved Community Mobilization	27
3.4	Improve Human Resource Capacity.....	28
3.4.1	Central Level.....	29
3.4.2	Regional Level	29
4.0	Conclusion.....	31

Executive Summary

Vector borne diseases such as malaria, dengue, lymphatic filariasis, continue to drive significant morbidity and mortality in Guyana. The establishment of capacity to undertake ecologically sound and cost-effective vector control interventions is a priority area in countrywide efforts to improve the control of these diseases. The development of such capacity must adequately respond to the existing challenges of decentralization. The Amazon Malaria Initiative (AMI) supported a national vector control needs assessment (VCNA) in Guyana from July 23 to August 2, 2012 to enable the Initiative better match its technical support to country priorities in vector control. The VCNA therefore aimed to:

- Assists each country in reviewing existing constraints to vector control and identify viable options/opportunities for addressing them. Particular emphasis is placed upon needs to achieve high impact outcomes in the short- to medium-term.
- Enables the integration of the discrete, on-going activities of AMI partners into the broader context of national and AMI priorities
- Provides a sound basis for developing specific activities to be included in a 3-year AMI work plan, based on country needs.

The output of the VCNA, served as the basis for the development of a three year AMI work plan on vector control¹. The multi-year work plan will be used by Guyana to detail out specific activities during the period.

Decentralization of Vector Control Services (VCS) in 2005 radically changed the way vector control is implement throughout the country, as well as the available resources. Currently, the Global Fund malaria project is the only entity providing vector control in Guyana; VCS is not involved in these operations. No entomological monitoring or surveillance for malaria is conducted, and the monitoring and surveillance performed for dengue is sporadic and poorly-organized.

¹ Enhancing AMI Technical Support for Sustainable Malaria Vector Control: A 3—year joint work plan by PAHO, CDC and RTI

A number of workers and technicians have been trained in vector control and entomology, and basic equipment is available at the central level and in the regions. However, both are not being used as effectively as possible. A primary reason is the absence of a national framework for vector control and related entomological monitoring and surveillance. There is an urgent need to support the development of such a framework – for which PAHO, CAREC and AMI are available to assist, in addition to supporting well-targeted human resource development. Once the framework is developed, the trained workers can be mobilized to perform the required vector control and entomology monitoring/surveillance activities, to routinely support decision making.

1.0 Introduction

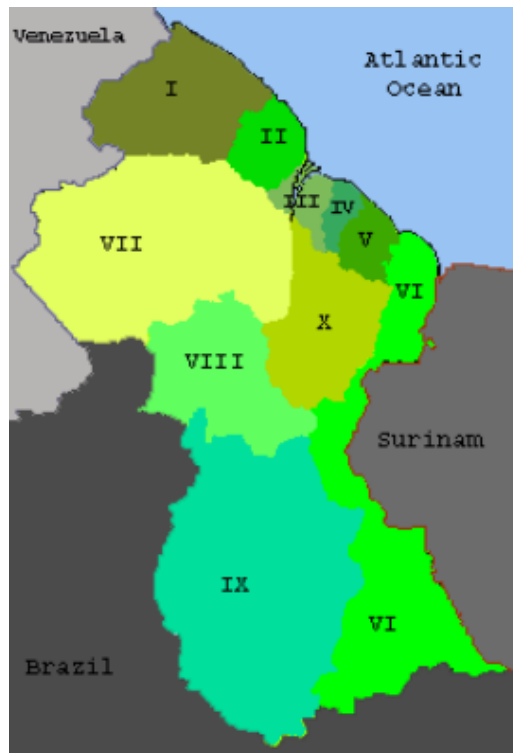
Guyana is part of the Amazon Malaria Initiative (AMI), which is a seven-country regional program that began in 2001 and whose objective is that “*Malaria control programs in the Amazon Basin sub-region substantially incorporate selected best practices.*” As part of ongoing efforts by AMI vector control partners (Centers for Disease Control and Prevention, Pan-American Health Organization, and RTI International) to improve vector control and entomological monitoring in the region of the Americas, vector control needs assessments (VCNAs) are being conducted to better match AMI technical support to country priorities. More specifically, the VCNA process:

- A. Assists each country in reviewing existing constraints to vector control and identify viable options/opportunities for addressing them. Particular emphasis is placed upon needs to achieve high impact outcomes in the short- to medium-term.
- B. Enables the integration of the discrete, on-going activities of AMI partners into the broader context of national and AMI priorities
- C. Provides a sound basis for developing specific activities to be included in a 3-year AMI work plan, based on country needs.

Malaria is endemic in the interior areas of Guyana in Regions 1, 7, 8 and 9, where 85-90% of cases occur in areas where gold mining is conducted (Figure 1). Vector Control Services (VSC) was decentralized and integrated into the primary health care system in 2005. With the lack of existing frameworks for vector control and/or entomology monitoring and surveillance and a dearth of financial resources, regions are encountering serious barriers to implementing vector control and no entomological monitoring is being conducted.

A number of strategies and guidelines exist that outline goals and methodologies for the control of malaria and other vector-borne diseases. For example, the National Health Sector Strategy’s (2008-2012) desired malaria outcome is “To prevent the outbreaks of vector borne diseases or epidemics by reducing the level of transmission that may cause any morbidity or mortality in Guyana.” Yet, these strategies and guidelines are largely ignored, and minimal emphasis is placed on vector control at both the national and regional levels, even though it is one of the best methods available to control disease transmission.

Figure 1: Administrative regions in Guyana: Malaria is endemic to regions I, VII, VIII and IX



Source: <http://botany.si.edu/hdp/regionlists/index.html>

2.0 SITUATIONAL ANALYSIS

This section summarizes the findings of the priority areas of assessment. Existing constraints are reviewed. Opportunities for addressing the identified constraints, or further improving vector management, are then discussed in Section 3.

2.1 *STRUCTURE, RESOURCES, AND FUNCTIONS*

2.1.1 Structure

Control of all vector-borne diseases is managed by Vector Control Services (VCS), a sub-department within the Disease Control Department in the Ministry of Health. Each vector-borne disease has its own disease control program within VCS, which manages the malaria control program, *Aedes*/dengue control program, and filariasis control program. The objective of VCS is “To ensure effective and efficient surveillance, prevention, treatment and appropriate control of vector borne diseases with interventions, including those recommended by WHO Global Strategies, as regards both, the disease and its associated vectors,” while its goal is “To prevent the outbreaks of vector borne diseases or epidemics by reducing the level of transmission that may cause any morbidity or mortality in Guyana.” (Vector Control Services website)

VCS is responsible for the diagnosis and treatment of vector borne diseases. It also provides oversight to vector control operations. At the time of the VCNA, the VCS Director position was vacant. The potential impact of the vacancy is further discussed under Section 2.1.5. The lack of uniformity presenting challenges to central level coordination.

Regional Vector control structure

The structure of vector control operations at the regional levels vary. Regional malaria control programs exist in the regions where malaria is endemic (Regions 1, 7, 8 and 9), and they occasionally coordinate with the Global Fund. The regional malaria programs report to the Regional Health Officer (RHO), who assumes the overall authority for VBDs control. There are also Regional Environmental Health Officers (REHOs), reporting to the RHO, who are responsible for checking for mosquito breeding sites and issuing fines if residents do not comply with local mosquito control guidelines.

In region 9, for example, the regional malaria program essentially encompasses the control of all vector-borne diseases. There are 54 health posts with 54 community health workers for the entire region who assist with VBD control, and also 18 malaria staff. These staff are responsible for making supervisory visits to communities throughout the region to check the work of CHWs, who take blood smears and diagnose cases. Regional vector-borne disease control consists of diagnosis and treatment; few formal vector control activities are performed. However, the REHO is also involved in dengue control, as environmental health workers inspect households and inform them of potential breeding sites. There is little coordination between the malaria program and the environmental health office, although there is possibility for them to work together in disease control.

Region 5 does not have a regional malaria control program, primarily because malaria is not endemic to the Region; cases are usually imported from other malarious regions. The hospitals undertake the diagnosis and treatment of cases. The prominent VBD in Region 5 is dengue, which influences the structure and function of vector control. There is a vector control committee that is composed of representatives from the EH office, laboratory personnel, clinical and hospital workers, and maintenance workers. The purpose of the committee is to prevent VBDs and if there is an increase in cases, to immediately provide community education and to provide fogging/spraying to kill the vector; although, at the time of the VCNA, this committee had not met in six months. Anti-mosquito provisions in the regional laws in Region 5 require that environmental health officers check for breeding sites during routine inspections. If there is evidence of mosquito breeding sites, and after being advised to clear the sites, households may be fined if they do not take action to get rid of the breeding sites. Environmental health workers fill out daily reporting forms, indicating the household location and the number of breeding areas and containers. EH workers are also responsible for food safety and inspections at hospitals, health centers and schools. There are only 9 EH workers for the whole region, which consists of 9 local authorities. The EH workers are able to travel throughout the region using public transportation; while this is cumbersome and time-consuming they are still able to visit nearly all communities. VC personnel from the central level are sent to the region if need arises, for example in the case of an outbreak. The central VCS provides lambda-cyhalothrin for residual

spraying, but the region uses it as a larvicide outside of hospitals and schools. Local authorities are unable to procure their own insecticides.

2.1.2 Decentralization

VCS was decentralized in 2005. The primary challenges caused by decentralization to vector control are:

- *Absence of a point person to coordinate central level response to the regions. This adversely effects communication between the regions and the central level (ref: Section 2.1.1)*
- *Insufficient human resources at the regional level to carry out routine vector control and surveillance*
- *Lack of resources, including transportation and funding*

There is little immediate contact with regions from central level, as there used to be regional supervisors based in Georgetown but decentralization eliminated these positions. In addition, those that were working in the regions now work for the Global Fund and report only to the Global Fund, even though they are still paid by the NMCP. PAHO has hired a regional vector control coordinator, who works with the regional vector control programs to identify problems and possible solutions, but his role is solely as an advisor. Funding runs out for this position at the end of 2012, and the future of the regional vector control coordinator role is uncertain.

Another impact of decentralization is inadequate program budget to the regions. For example, before decentralization the regions had sufficient transportation, such as vehicles and boats, to travel to malarious areas for vector control operations such as IRS. However, the means of transportation have fallen into disrepair, and the regions have no funds available for repair costs. In some regions, a few vehicles (including all-terrain vehicles) have been donated by the Global Fund.

A 2011 PAHO report on the decentralization of malaria control in Guyana (“Degree of Decentralization and Integration of Malaria Program into the PHC Services”), recommends numerous changes to the organization of malaria control, including a reorganization of malaria

control at the national level, so that NMCP and Global Fund Malaria Project share a director. The report also provides a number of short to medium-term solutions to improve malaria control. The recommendations of the PAHO report are feasible and well-informed. However, conflicting views of stakeholders have impeded further action.

2.1.3 Information Management for Vector Control

Challenges to information reporting in Guyana are

- *Lack of computerized data or systematic data collection.*
- *Inadequate communication between vector control actors*
- *Parallel information systems for malaria control program and Global Fund Malaria Project*

The only functional information system is the Malaria Information System (MIS), which is supported by AMI/RAVREDA. The information on malaria cases is sent from the communities in the regions to the regional malaria coordinator, who then submits the information to MIS. Regions send information on cases on a weekly or monthly basis, and data is only accepted in a written or computerized format. Most of the data reporting at the regional level is hand-written. Regions react first if there is an epidemic by sending several teams to do mass blood surveys and treatment. Weekly epidemiology reports compiled from the MIS are sent to the Minister of Health, CMO, Director of Regional Health Service (oversees regions), Global Fund project director, VCS medical officer and regional vector control coordinator. The Global Fund and VCS use different indicators for case reporting (such as definitions for case re-checks and new cases). This has resulted in two almost isolated reporting systems. There is a need to standardize case reporting between the two systems, as the current reporting methods are confusing for those at the ground level. An ideal situation is to unify the two systems into a single national reporting system. No mapping of case rates for vector-borne diseases has been done.

There is also an active population-based surveillance program in place: community health workers take blood smears every month as a mass blood surveillance program. Everyone in each community is sampled, and schools are priority areas. CHWs are supposed to report the number

of smears tested and numbers of *P. vivax*, *P. falciparum* and *P. malariae* by community. Most CWHs report monthly, and others report quarterly; all reports are hand-written, including those submitted by the malaria department to the RHO.

The Regional Environmental Health Officers do not receive reports on the number or location of dengue cases; dengue rapid tests are performed in the hospital laboratory and the results are sent directly to the RHO each month. The dengue control program field inspectors at the central level provide weekly report to main supervisor with the number of houses inspected at the Capital (Georgetown), number of containers with larvae, and how much temephos was applied. The supervisor then gives a monthly report to the Chief Inspector, although this information is not computerized or utilized at a later date for monitoring activities. There is no database of dengue cases and case numbers are extremely difficult to encounter. Dengue case reports are compiled within local hospitals, and then submitted to the Regional Health Officer, who then sends reports to the national level. Information on dengue cases is not made available to the REHO, who is responsible for dengue vector control.

The former VCS director was developing a plan for a computer system at the malaria program office, with one computer for doctors, one for pharmacy, and one for information system, but he has since transferred to the Global Fund and it is unknown how far he got in planning stages. Regions 1 and 9 have computers, but they have been broken for some time (region 9's computers date back to 2004). The malaria department is working with the REO to budget for a new computer, but the malaria office is not secure enough to house a computer without risk of theft.

2.1.4 Human Resources

The primary challenges to human resources for vector control and entomological monitoring are:

- *Vacancies at the central level for key positions*
- *Insufficient human resources at all levels for vector control and entomology*
- *Trained entomologist and malaria vector control technicians are employed by the Global Fund (on the GF Malaria Project) and do not communicate/collaborate with VCS*

Within VCS, there are a number of vacancies, including VCS director, three medical officers, two senior inspectors (one for the malaria control program and one for the dengue control program), and numerous charge operator inspectors (usually one inspector for each region). Funding is available for the above positions, and there are professionals available within the country who could be hired to fill the vacancies, however the vacancies are not advertised or made public for inexplicable reasons. There are also few opportunities for VCS employees to advance their careers, and trainings are not available. The Global Fund, which is able to pay higher salaries than VCS, hired the only entomologist and a number of entomology and vector control technicians, further detracting from the human resources available in VCS. In addition, Global Fund provides performance allowances for some regional staff such as CHWs and malaria control technicians. The regional vector control programs are however, unable to provide such allowances, so the staff are unwilling to assist regional programs when the Global Fund is paying them more. There is very little coordination or collaboration between the Global Fund project and the VCS. The situation is a major limitation to effective vector control in the country and needs to be urgently addressed.

Before the 2005 decentralization of VCS, the regional malaria program had sufficient transportation and personnel. The regional programs used to have laborers in the regions who were trained to be field assistants and also performed microscopy; these assistants are no longer employed due to lack of funds. Following the 2005 decentralized, staff based in Georgetown (the capital) was sent to the regions to carry out the vector control activities. However, the staff positions were administratively still located at the central level – in effect there were no actual vector control positions created at the regional level. Therefore, as the transferred staff retired or changed jobs, their positions were not filled, leaving a deficit of human resources in the regions. Currently no one is being hired to work in the regional VCS, even though there are a number of job openings; the malaria program is trying to hire through the Public Service Ministry. Regional staff are overextended with their current duties, and even though they have received training in entomology and there is equipment, such as spray canisters, the regions are unable to hire even temporary workers to assist in vector control, due to financial constraints. The result is that there is hardly any malaria vector control and entomological surveillance.

CHWs and medexs (trained nurses with an additional year of health care training) are posted in the regions and communities, currently assisting in malaria diagnostics and treatment. There is a possibility to increase their scope of work to include community mobilization for vector control and assistance with rudimentary vector control interventions (such as disposal of receptacles).

2.1.4a Training

The primary challenges to training received for vector control and entomological monitoring and surveillance are:

- *Lack of regular standardized trainings at central and regional levels*
- *Competencies gained from training are not integrated into job descriptions; therefore trained employees do not perform vector control/monitoring tasks*
- *Lack of national framework for vector control and entomological surveillance*

Training for vector control and entomological monitoring is sparse and usually supported by the Caribbean Epidemiology Center (CAREC). To compound the challenges, the absence of a framework for malaria vector control and entomological surveillance, means that trained technicians have no framework within which to perform the activities that they have been trained in. CAREC, supported by RAVREDA, conducted 15-day training in 2009 in Lethem (Region 9), for two people from each region. Participants learned how to collect adult mosquitoes and basic taxonomy. In 2011, training in basic entomology was conducted by CAREC for microscopy technicians. The technicians learned how to collect and preserve adult and larval mosquito specimens and basic taxonomy. However, these tasks were not included in their job description and are conducted on a voluntary basis.

There is a need for training in insecticide application and use of equipment. This is critical to ensure judicious and effective use of public health insecticides for both malaria and, increasingly, for dengue control.

2.1.5 Financing

The exact level of national budget for malaria could not be determined by the VCNA. However the 2012 malaria control budget has been reduced (Pers. Comm. Staff of VCS). The annual Global Fund budget for the current malaria control grant is approximately one million USD, on

average per. From September 2011 to June 2012 the Global Fund malaria project spent around \$650,000 in Guyana. AMI/RAVREDA also provides funding for malaria control in Guyana.

2.1.6 Potential Collaborative Institutions and Programs

There is an absence of collaboration and coordination between the major vector control outfits in the country. This is a serious limitation to effective and sustainable vector control efforts. There are a number of programs and institutions with whom VCS could collaborate or coordinate efforts to improve vector control and monitoring/surveillance operations. These are reviewed in the following sections.

2.1.6a Global Fund

The Global Fund is financing a malaria project in regions 1, 7, 8, and 9. The Global Fund malaria grant currently supports the following positions for the malaria control: grant director, senior monitoring and evaluation technician, four quality control technicians (based in the regions), an administrative assistant to the director, a computer operator, and six drivers. As part of the current grant agreement, the Global Fund is requiring that the program in Guyana hire a deputy director, a post which is currently vacant. The grant also provides performance allowances for up to 40 CHWs, up to 12 malaria control staff and up to 8 medexs in the regions, and supports training of microscopists. There are also regional malaria officers, or RMOs, (separate from the malaria coordinators) who are employed by the regions, but work for the Global Fund. The RMOs organize and coordinate LLIN distribution. The Global Fund is collaborating with PAHO to conduct an LLIN usage study. No insecticide residual efficacy tests are conducted on distributed LLINs, or under the IRS program.

There is little/no collaboration or coordination between the Global Fund malaria control program and the national malaria control program at neither the central nor regional levels. They function as two separate disease control programs. Regional health authorities have no role in reporting malaria case numbers to the Global Fund; the numbers of malaria cases reported to the through the Global Fund Project are not used at the regional level as the regional malaria control program has a parallel system (ref: Section 2.1.4).

2.1.6b Human Rights Programme

The NGO Human Rights Programme (HRP), which is based in Georgetown, is interested in promoting community mobilization for vector control. HRP is currently involved in community mobilization efforts for environmental protection and cleanliness, and the primary mode of communication is pamphlets and emails. The primary focus area is currently Region 4 (where Georgetown is located), and a university biologist, who sits on the HRP board of directors, travels to the interior part of the country in an attempt to expand the reach of HRP. HRP is interested in working with the Ministry of Health, but there seem to be little response.

2.1.6c Georgetown City Council

The Georgetown City Council is involved in dengue control efforts in Georgetown city limits. There are four environmental health officers (EHOs) within the City Council who were trained by the University of Guyana and primarily engaged in dengue control; they check for dirty yards and potential breeding spaces, giving notices to households that they need to tidy up their yards. The EHOs, however, work primarily in the center of Georgetown and are usually not able to cover the whole city. The EHOs submit monthly reports on how many mosquito breeding sites were found and where. If the households do not comply, they receive a summons and have to go to court to pay a fine, the amount of which depends on the magistrate's own judgment. However, the funds received by the government for the fine do not go back to the City Council's vector control efforts: the government uses the funds as they see fit.

The City Council has limited financial resources for vector control. There are vector control workers, engaged by the City Council, who work with the EHOs, and have received training from PAHO. The vector control workers occasionally perform fogging operations with borrowed equipment from the VCS dengue control program (the City Council fogging machine is broken).

2.1.6d UNICEF

The UNICEF office in Georgetown is collaborating with the government of Guyana in a number of different areas:

- Collaborating with the MoH to use the “*Marginal Budgeting for Bottlenecks*” tool. This tool develops costing strategies to project funding shortfalls and to cost services, such as human resources, in the achievement of the Millenium Development Goals.
- Evaluating the usage patterns of LLINs among children and mothers and advocating for reduction of import taxes on LLINs.
- Developing a training curriculum for community-based implementation of interventions
- Supporting the improvement of the Health Management Information System. UNICEF is working with a number of bureaus and ministries, including MOH, the Bureau of Statistics, Ministry of Human Services, and the Ministry of Amerindian Affairs. Much of the monitoring being done is anecdotal and data/information collected is not used constructively. The objective is to obtain quality data that is used for decision-making and action. UNICEF is working on data management in three aspects:
 - i. *Quality of data*: This includes data flow, what should be collected (including indicators), what is done with the data, etc.
 - ii. *System design*: Including how to design an information system so that it is relevant and avoids double-counting, among others
 - iii. *Political influence*: This primarily encompasses how to effectively share data with the public and how to understand the meaning of various types of data.

2.2 MAJOR VECTOR-BORNE DISEASES

2.2.1 Malaria

Malaria is endemic in regions 1, 7, 8 and 9, in the interior part of the country where gold mining is taking place. Case numbers have been steadily increasing since 2008, as shown in Figure 1. No mapping of disease prevalence or rates has occurred. The primary vector is *An. darlingi*, and both *P. vivax* and *P. falciparum* are present.

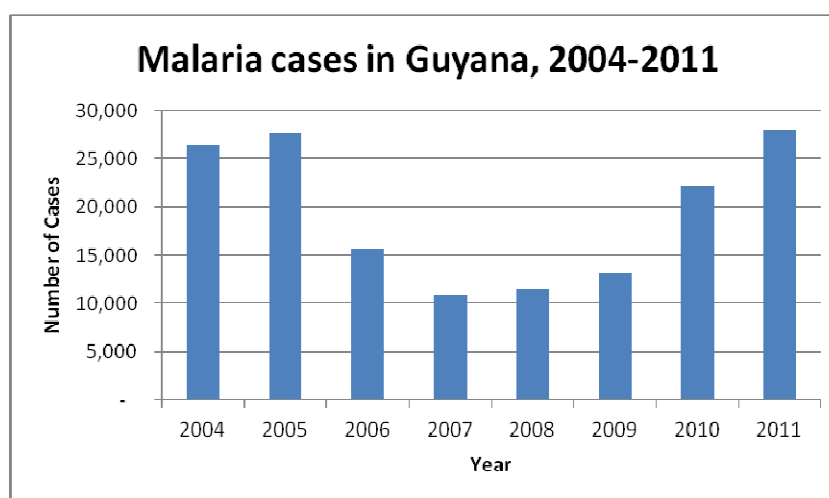


Figure 1: Malaria cases in Guyana were decreasing until 2007, after which point they have been increasing steadily. (Source: Guyana Malaria Information System)

2.2.2 Dengue

Dengue is endemic throughout Guyana, however little official data exists on the scope of the problem. In 2011 PAHO worked with VCS to develop an Integrated Dengue Management system. However the system is yet to be fully implementation. Weekly Epidemiological records by PAHO (Table 1) indicate the following cases:

Table 1: Cases of Dengue and Dengue Heamorrhagic Fever in Guyana 2009 - 2012

Year and week	Clinical cases	Confirmed cases
2012, week 24	383	383
2011, week 52	1,093	1,093
2010, week 37	8,100	2,200
2009, Week 32	733	492

Source: <http://new.paho.org>. Accessed 26 September 2012.

2.2.3 Lymphatic Filariasis

Lymphatic filariasis (LF) is endemic in regions 2, 3, 4, 5, 6 and 10 with pockets of cases in region 8 (Fig. 1). It is transmitted by *Culex* mosquitoes and the primary intervention is mass drug administration (MDA), which is done once a year with albendazole and diethylcarbamazine citrate (DEC). The LF control program is part of the VCS and is run by the CMO. MDAs started in some regions in 2008, however regions 3, 4 and 10, have yet to start drug distribution.

2.2.4 Leishmaniasis

There are a small number of cases each year of cutaneous leishmaniasis, and there is a possibility that gold miners from Brazil may bring visceral leishmaniasis into Guyana. Leishmaniasis is transmitted by *Lutzomyia* sandflies, but little is known about what specific species exist in Guyana.

2.3 TOOLS, METHODS, STRATEGIES, AND COVERAGE

2.3.1 Long-Lasting Insecticidal Nets (LLINs)

Some of the primary challenges identified in the use of LLINs in Guyana are:

- *Lack of communication between Global Fund and VCS regarding number of LLINs distributed and location of distribution*
- *Up-to-date information on usage rates, particularly among the most vulnerable subpopulations*
- *Need for increased awareness of how to properly use LLINs*
- *No field evaluation of effectiveness*

The Global Fund procured and distributed 16,000 LLINs in 2012 in regions 1, 7, 8, and 9.

Procurement of 11,000 LLINs is targeted for 2013. The distribution of the Global Fund LLINs is absorbed by the regional governments. The LLINs are distributed to miners, many of whom are from the coastal areas. When the miners return to the coast (where malaria is not endemic, but there are many mosquitoes), in many cases they take the LLINs home to their families and leave

them there, rather than returning to the mining camps with the nets. This represents a recurring challenge to adequate coverage of mining communities. Hammock nets have also been distributed; current numbers, however, are not available.

2.3.2 Indoor Residual Spraying (IRS)

The following challenges to IRS operations in Guyana were identified:

- *The absence of a central role of VCS and regional malaria control programs in IRS operations.*
- *Difficulties in providing effective coverage for mobile populations in mining communities with semi-permanent housing.*
- *Lack of funding for trained personnel who could function as spray operators*

During the malaria eradication campaign, IRS with DDT was carried out through most of the regions. In Region 9, which was visited by the VCNA team, IRS was conducted twice a year in the north and southern parts, prior to the 2005 decentralization of VCS. The malaria control program employed laborers, spray teams and spray supervisors and had the equipment for operations. Currently however, the regional malaria programs do not conduct IRS operations. Although the programs have spray pumps and some related IRS equipment, there is no personnel to operate them. Global Fund Malaria Project manages all current IRS operations and VCS is kept uninformed of operations and outputs; the VCS is plays no role in the planning, implementation and monitoring of the IRS operations. IRS for malaria control is implemented in Regions 1, 7 and 8. Spraying activities began in 2011, using pyrethroids. In the first part of 2011, from March to August, approximately 2,300 structures were sprayed. This included 1,000 households in Region 8 (Madia), 700 households in Region 7 (Bartica) and 600 dwellings in mining areas in Middle Mazaruni in Region 7. In the latter part of 2011 IRS activities covered an additional 500 households in Region 8 and 1,000 dwellings in mining camps in Region 1.

IRS is also done for dengue control in Georgetown, where the dengue program sprays lambda-cyhalothrin in key buildings, such as hospitals and schools.

2.3.3 Fogging for dengue control

The main challenges to fogging operations for dengue control include:

- *Lack of functional equipment and limited training of personnel on fogging*
- *No evaluation on the effectiveness of the fogging operations*
- *Large numbers of people are necessary for fogging operations for protection reasons, as workers are pelted with debris by local teenagers*

Guyana uses malathion mixed with diesel fuel (1:22) for fogging for dengue control. It is scheduled to be done three times a year in Georgetown, but it is only done twice due to lack of equipment. Of the two foggers in Georgetown, only one is functional; the other has been broken for over a year. Fogging takes place from 18:00 to 22:00, and the last training on fogging methods was in 2007 – some 5 years ago! There are no evaluations to verify the effectiveness of the fogging operations.

In Georgetown, fogging is done in large teams, with one driver and three technicians operating the equipment. Local teenagers throw debris and rocks at the fogging operators, which the latter has termed “getting bricked.” Because of this, there is little interest by the dengue control team in performing fogging operations (no one was to be pelted)².

Region 9 has two functioning swing foggers (the third is broken). There had been no fogging activities in 2012, as at the time of the VCNA (August). Fogging is conducted during dry weather twice a year in the areas of St. Ignatius, Culvert City, Lethem and Tapachinga. Fogging is done from 18:00 to 21:00 to correspond with peak mosquito biting hours. The region used to employ porters from the hospital to assist with the fogging, but financial resources are no longer available for this.

² The diesel-based solvent, which has the benefit of preventing evaporation of the insecticide droplets, also creates smoke and leaves a residual pungent smell. This is known to result in rejection of the fogging by communities in other countries. This, and the fact that the spray time stretches all the way 22:00 hrs, may explain the apparent hostility by the children towards the fogging operators. It may be worthwhile for the program to find out the real reasons for the hostility.

2.3.4 Larval Source Management

The primary challenges to larval control in Guyana are:

- *Lack of strategic use of larvicide (temephos)*
- *Insufficient/poor quality stocks of larvicide at the regional level*

The dengue control program monitors potential larval habitats throughout Georgetown with the use of temephos. The temephos, however, is not distributed to regions where dengue is also endemic. Dengue larvae are found in old tires and garbage in Region 5, but they have not appropriate larvicide available. In Region 9, the vector control program has temephos, but it is not suitable for drinking water because it had been subjected to flooding in 2005 in Georgetown. In addition to being expired and less effective than desired, the temephos cannot be applied in many situations.

2.3.4a *Bacillus thuringensis*

The Canadian International Development Agency (CIDA) funded a pilot project for community participation in growing *Bacillus thuringiensis* (*Bti*) in coconuts in 2010. The project took place in the communities of Bush Lot and Mikobi in Region 5 (which is not endemic for malaria) with technical assistance from Dr. Palmira Ventosilla, a researcher from the Cayetano University in Peru. While the project was initially successful, during follow-up the regional environmental health workers found that more than half of the coconuts had been discarded because of the rancid odor associated with the fermentation process. The Ministry of Health has expressed interest in the use of *Bti* to control immature stages of the malaria vector.

2.3.5 Insecticides

Insecticide susceptibility tests for pesticides used for public health purposes in Guyana have never been conducted. Other primary challenges to insecticide storage and use are:

- *Lack of adequate storage facilities*
- *Improper/insufficient labeling of insecticides containers*
- *Lack of pesticide distribution channels*

- *No quality control of procured insecticides*
- *Inadequate training of insecticide handlers*

The selection of insecticides and larvicides for vector control (permethrin, lambda-cyhalothrin, malathion, and temephos) is done with very little scientific evidence. For example, no susceptibility tests are performed. There is also no laboratory capacity in country to test the quality of procured insecticides to ensure that they meet the recommended specifications by WHOPES and national authorities.

Guyana also lack appropriate storage for insecticides. In Georgetown larvicides and insecticides are stored in a large warehouse at the Dengue Control Program office. Some of the larvicides currently in stock were present when Georgetown flooded in 2005, rendering them unsafe for use in drinking water.

There are no training programs in place to certify insecticide handlers and spray operators. Field supervision of spray and fogging operations is also inadequate.

2.3.6 Entomological Monitoring

Currently entomological monitoring and surveillance for vector control is not performed. The main constraints to monitoring and surveillance are:

- *Lack of a framework for entomological monitoring and surveillance*
- *Lack of trained entomologists*
- *Insufficient human resources for entomological monitoring and surveillance at regional and central levels*
- *Absence of insectaries or entomology laboratories throughout the country*

The absence of a national framework for entomological monitoring constrains the determination of requirements (infrastructure, human resources, methodologies, indicators etc.) for generating an adequate body of local evidence to support vector control. The inability of VCS and regional programs to monitor insecticide susceptibility hinders the sound selection of insecticides. It also poses a risk to the continued utility of currently used insecticides as the earliest signs of growing

resistance (reducing susceptibility) may be missed. CAREC has offered to conduct susceptibility testing for local vector populations, but there has been no movement in this area³. Ultimately, country capacity for entomological surveillance and monitoring, including the capacity to evaluate the bio-molecular drivers of insecticide resistance, is critical to the establishment of a robust resistance management scheme and providing ongoing sound basis for vector control decisions.

There is only one medical entomologist in Guyana, who currently works with the Global Fund. The lack of collaboration between the Global Fund and VCS makes it difficult for the entomologist to provide guidance to national monitoring and surveillance activities.

While there are malaria workers who have been trained in mosquito collections, basic taxonomy and adult/larvae collections, there are no insectaries or entomology laboratories in Guyana. There are plans to install an insectary in the dengue control program facility in Georgetown, but there has been little progress towards the construction.

2.3.7 Community Mobilization

There are several NGOs (e.g. HRP) engaged in community mobilization for a variety of health improvement objectives. For vector control, however, community mobilization efforts are woefully inadequate. There is an urgent need for public education to keep surroundings clean, particularly in Georgetown. This is critical to the control of dengue and lymphatic filariasis. Large amounts of garbage accumulation in parts of the city - on both streets and in canals - provide an ideal breeding source for mosquitoes. Garbage pickup is privatized, and the city council and relevant authorities must improve mobilization to encourage cleanup efforts.

2.3.8 The Special Case of Mining and Other Mobile Communities

The following challenges were identified in regards to mining operations in Guyana:

- *85-90% of malaria cases occur in mining areas, which are often inaccessible and populations are susceptible to malaria*

³ This is an opportunity for early impact for AMI – supporting the development of local capacity for susceptibility evaluation, which hinges on a viable framework for entomological surveillance and monitoring.

- *Standard vector control measures are of limited effectiveness and it has been difficult to find suitable and effective vector control interventions*
- *Miners take distributed LLINs back to their families rather than using them in the malarious camps*

Between 85 and 90% of malaria cases occur in gold miners and the surrounding population in inaccessible areas in the interior part of the country. The increase in the price of gold has caused people seeking employment go to mining areas from the coastal areas, where they have never been exposed to malaria (and are therefore susceptible). Amerindians and Brazilian immigrants also work in the gold mines. The miners regularly work 24 hour shifts, rendering the usual interventions, such as IRS or LLINs, ineffective.

The regional vector control coordinator met with a group of miners and asked them what VCS could do to help treat malaria in the mining camps. The need to transport the diagnostic and treatment services of the malaria control program to the mining was identified; the regions are unable to pay per diem but the miners have agreed to pay a total of 2.1 million Guyanese dollars (about 10,500USD) for the malaria control workers to come to the camps to diagnose and treat malaria. A draft of the plan was sent to the CMO, and the Ministry of Geology and Mines has requested to see the plans before further action can be taken.

3.0 OPPORTUNITIES FOR ADDRESSING VECTOR CONTROL CHALLENGES

3.1 Improved Data Management and Utilization for Vector Control

The following opportunities are identified for improving the management and utilization of vector control data:

- *Development of a unified vector control reporting system and mandating the sharing of information between the national programs and Global Fund project.*
- *Strategic placement of computers at the regions and central level to enable digitization of information.*
- *Targeted training on vector control data management and utilization to create a critical mass of trained personnel*

As information is currently recorded by hand, it is difficult to manage and utilize for decision making. For example, currently the Dengue Control Program submits handwritten monthly reports on monitoring activities and temephos application. However, they are unable to use this information to guide subsequent activities because it is not easily accessible. If the data were electronic, and necessary indicators, such as House Index and Container Index, are included, the control program would be able to easily identify dengue hot-spots throughout the city and then focus their control efforts.

The lack of computers seriously hinders effective information management. A priority will be to support strategic placement of computers at the regions and the development of electronic records. AMI/RAVREDA, CAREC, PAHO and Global Fund should consider supporting procurement of a few computers and conducting targeted training on data management and utilization for vector control. To ensure that such investment elicits the desired outcome, job descriptions of the data managers must be clarified. A starting point will be utilizing the existing staff whose current functions can readily accommodate the added role as data entry staff and data managers. The data entry/management platform (i.e. software) must be readily available (e.g. Epi-Info or Microsoft Excel) to facilitate information sharing. In order not to duplicate efforts, it

is reasonable to start with evaluating the platform and data collection system that the Global Fund project is utilizing, since it is reasonably digitized.

As a start, sharing of vector control information must be mandatory for the control programs and project. In particular the national and regional malaria control programs must have access to information gathered by the Global Fund malaria project and vice versa. The current lack of communication is unacceptable and detrimental to effective national vector control efforts. Additionally, reporting lines, nature of reports and roles of the various information management levels (regional, central and special projects/initiatives) must be clarified. The information management scheme should be linked to the development of a national scheme for entomological surveillance and monitoring (See Section 3.2)

3.2 Develop Framework for Entomological Monitoring and Surveillance

The following constraints were identified:

- *Lack of a national framework for entomological monitoring and surveillance*
- *Lack of trained entomologists to guide monitoring activities*
- *Insufficient human resources at regional and central levels for entomological monitoring and surveillance*
- *Absence of relevant infrastructure (e.g. insectaries , entomology laboratories and equipment)*

Entomology surveillance and monitoring is a prerequisite to effective and sustainable vector control. The absence of a national monitoring scheme in Guyana means a dearth of knowledge on the status of local vectors, disease transmission and the utility of ongoing vector control interventions. The lack of capacity for insecticide susceptibility tests and resistance monitoring, for example, presents a serious risk to the continued utility of insecticide-based tools (IRS, LLINs, chemical larvicides etc.).

It is recommended that an entomological monitoring and surveillance framework is established as a first step. The framework will enable a systematic collection of priority entomological data (indicators, collection methods and frequency of measurements) and will clarify modalities for its management and utilization (Section 3.1). It will also enable a proper determination of the

resources required (human, technical infrastructure, institutional, financial, training needs etc.) for the implementation of a credible national entomological surveillance. Budgeted work plans can then be developed to mobilize the relevant resources.

3.3 Improved Community Mobilization

A number of opportunities exist for VCS to strengthen community mobilization efforts at both the central and regional levels:

- *Georgetown City council should enhance collaboration with VCS to mobilize community for clean-up efforts, including public education on waste management*
- *Explore strategic partnerships with NGOs to strengthen community mobilization efforts for vector control, which are currently weak*
- *CHWs and medexs already working in the communities can assist in community mobilization for vector control, including proper disposal of receptacles and other potential breeding sites*

VCS's current community mobilization efforts are irregular and weak. Current difficulties in performing routine vector control activities, such as the reluctance of fogging operators to undertake fogging for dengue control in Georgetown, where they are pelted with small objects, may be due to inadequate community education on the fogging activities. The Georgetown City Council and VCS must work together to improve community mobilization for vector control. It is noted that the City Council Environmental Health Manager has a working relationship with the CMO/VCS and has approached the latter about working together. The CMO has agreed to this and there is optimism that the City Council and VCS will harmonize their efforts in the future.

A number of non-governmental organizations (NGOs) function inside Guyana, and this resource is largely untapped by VCS. VCS should partner the NGOs that are currently involved in a variety of health improvement efforts at the community level, and demonstrate strong community mobilization efforts and outreach. Innovations to improve community sanitation for dengue control could include (i) organizing competitions for the “best-kept yard” in the various neighborhoods in Georgetown and surrounding areas, and (ii) providing lessons in schools to educate children on vector control methods. It has been shown in many countries that the

students, in turn, would take vector control messages back to their families. CHWs and medexs are able to assist with these activities at the regional level, increasing community acceptance of interventions such as IRS and LLINs and better compliance with routine measures, such as LSM.

3.4 Improve Human Resource Capacity

Opportunities for human resource development fall into three broad areas:

- *Clarify roles and responsibilities for vector control and the central and regional levels*
- *Define human resource development needs for vector control and develop strategy for implementation*
- *Enhance collaboration with institutions in the Americas (e.g. PAHO, CAREC, AMI) to address shortfalls.*

Serious human resource deficits at both the central and regional levels constrain successful implementation of vector control and entomological monitoring and surveillance. There are specific and general functions for the various administrative levels in national vector control (Table 2). For Guyana, these roles will need to be clarified to better determine the relevant competences and job descriptions, as well as the numbers and placement of staff at the various levels.

Table 2: Desirable core functions and roles for vector control

National/Central Level	
<ul style="list-style-type: none"> • Strategic direction to programs • policy development • Standard settings, norms and M&E indicators • Program funding/resource mobilization • Prioritize and allocate financial resources • Epidemiologic analysis • Quality assurance • Training and support for district/Sector programs and vector control 	<ul style="list-style-type: none"> • Coordination of emergency response • Evaluation and validation of operational research • Decision-making and planning of district programs/activities • Determine human resource needs • Monitor and evaluate district/Sector IVM implementation
Regional Level	

<ul style="list-style-type: none"> • Local planning of implementation • Resource prioritization and allocation • Disease surveillance • Program monitoring • Health education 	<ul style="list-style-type: none"> • Train field staff/village health volunteers • Undertake vector control activities, assist in operational research • M&E: collection and initial collation of local data on various VC aspects)
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3.4.1 Central Level

Apart from the general opportunities indicated above, specific opportunities at the central level include:

- *Fill current vacancies for key central level positions, such as VCS director and medical officers*
- *Share roles with relevant institutional/outfits to increase human resources available for vector control and entomology*

The long standing vacancies in leadership positions, including the position of director, at the VCS must be urgently addressed. There should be no barriers to hiring qualified personnel to fill these vacancies; the VCNA team was informed that the salaries for these positions are included in the budget and separate from funds for on-going activities. A substantive director for VCS is urgently needed to ensure effective institutional management, which should improve VCS functions.

Without an entomologist, VCS needs to seek guidance from CAREC and PAHO on how to structure vector control and for assistance with basic entomology surveillance, such as insecticide resistance testing. Vector control technicians in the regions should be mobilized to effectively provide input to the central level as to how to strengthen existing efforts and how to overcome the communication barrier between central and regional levels.

For Georgetown, close collaboration between VCS and the City Council will broaden the human resource available and improve the scope of vector control efforts throughout the city, as the two institutions share roles and reinforce each other's functions.

3.4.2 Regional Level

Specific opportunities at the regional level include:

- *Leveraging CHWs and medexs for community education on vector control*
- *Enhancing collaboration between the regional malaria control programs and the Global Fund Malaria Project*

The CHWs and medexs work in their own communities and are trusted by community members. Their scope of work could be augmented to address community education on vector control. The Acting Director of Health Services Education, which trains CHWs and medexs, is in agreement with the expansion of their job descriptions to include assistance with vector control in malaria endemic areas. An ideal end goal will be to include more in-depth information on vector control and biology in the training curriculum of the CHWs and medexs.

Similar to the central level where close collaboration between VCS and the City Council of Georgetown will enable increase scope of vector control activities, the Global Fund malaria project, in particular, has capacities that could be harnessed to support capacity development within the regions where the project is active.

4.0 Conclusion

The AMI vector control partners will need to support the VCS to translate the findings and recommendations in this report into actionable activities. The VCNA is an initial step in a larger process aimed to develop a framework for inform a recalibration of national vector borne disease control efforts. The expectation is that it will lead to the development of feasible and measurable work plans to address current limitations to vector control in Guyana in a more comprehensive manner.

Sources

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